REMARKS

Claims 1-15 are pending. No new matter has been added by way of the above amendments. For instance, the claims have been amended to recite a "yttrium or lanthanide-containing compound" as supported by the present specification at page 6, lines 32-35 and page 10, lines 13-15. Further reference may be made to page 7, lines 1-3 and page 10, lines 4-7. New claims 9 and 10 are supported by the present specification at page 7, lines 4-5. New claims 11-14 are supported by the present specification at page 7, lines 20-24. Lastly, new claim 15 is supported by the present specification at page 7, line 19. Accordingly, no new matter has been added.

In view of the following remarks, Applicants respectfully request that the Examiner withdraw all rejections and allow the currently pending claims.

Issues Under 35 U.S.C. § 112, Second Paragraph

The Examiner has rejected claims 1-8 under 35 U.S.C. § 112, second paragraph for the reasons recited at page 2 of the outstanding Office Action. In particular, the Examiner has rejected the phrase "consisting essentially of rare-earth element (inclusive of yttrium-containing compound). Applicants traverse

and submit that the claims have been amended to specifically define a yttrium or lanthanide-containing compound. Accordingly, this rejection is moot. Reconsideration and withdrawal thereof are respectfully requested.

Issues Under 35 U.S.C. § 102(b)

The Examiner has rejected claims 1, 2 and 5-8 under 35 U.S.C. § 102(b) as being anticipated by Kaneyoshi, JP 08-119632 (hereinafter referred to as Kaneyoshi '632). Applicants respectfully traverse this rejection.

The Present Invention and Its Advantages

The present invention discloses thermal spray spherical particles of rare earth-containing compound, in particular yttrium or lanthanide containing compound, useful for thermal spraying on ceramics or a metal.

It is a common practice in the art to thermally spray metal or metal oxide particles onto metal or ceramic substrates to form a coating thereon for imparting heat resistance, abrasion resistance and corrosion resistance. The properties of the coating thus formed depend on the spraying conditions as well as the properties of powder particles to be sprayed.

While plasma processes are used in recent semiconductor fabrication, rare earth-containing compounds have been developed as a wafer processing component in corrosive halide gases because they have high resistance to plasma.

Spray coatings which contain fewer impurity elements other than the predominant constituents and have fewer irregular, smooth surface bearing fewer fines are required for such components because they are able to suppress dusting during wafer processing. To meet these requirements, it becomes crucial to control the properties of powder particles to be sprayed as well as the spraying conditions. However, prior art techniques have many defects as discussed in the specification and have not achieved satisfactory results.

The present invention overcomes the problems confronting the prior art and provides thermal spray spherical particles which meet the above requirements. That is, the present invention provides thermal spray spherical particles which have a sufficient breaking strength to remain uncollapsed in the flame or plasma during spraying, more particularly, spherical particles for thermal spraying, consisting essentially of a yttrium or lanthanide-containing compound and having a breaking strength of at least 10 MPa and an average particle diameter of 10 to 80 μm.

The present invention also provides thermal spray, high purity particles of yttrium or lanthanide-containing compound which can be thermally sprayed to form a smooth, dense coating despite the high melting point of these compounds, and without generation of fines. More particularly, the present invention also provides spherical particles for thermal spraying, consisting essentially of a yttrium or lanthanide-containing compound and having a bulk density of at least 1.0 g/cm^3, an aspect ratio of up to 2, and a cumulative volume of pores with a radium of up to 1 μm which is less than 0.5 cm^3/g.

No anticipation exists based on Kaneyoshi '632.

Kaneyoshi '632 discloses a method for preparing a rare earth hydroxide by mixing an aqueous solution of rare earth hydroxide and an aqueous solution of ammonia or alkaline hydroxide to react and precipitate the rare earth hydroxide therefrom. According to Kaneyoshi '632, at least one of the aqueous solutions is dispersed in an organic solvent which is not mixed with water homogeneously and added to the reaction solution. A rare earth oxide is obtained by calcinating the thus obtained rare earth hydroxide.

Kaneyoshi '632 discloses that the majority of particles of the rare earth oxide are spherical when observed under an electron

microscope. The particles may have a maximum diameter/minimum diameter ratio of up to 1.5 and smaller angle of repose than that of the usual oxide particles. The powder can be used for thermal spraying.

The Examiner asserts that the claimed breaking strength and bulk density will be inherently met by the prior art spherical particles since the materials disclosed by Kaneyoshi '632 are the same as that disclosed in the present application.

Kaneyoshi '632 is concerned only with a fluid of the particles. Kaneyoshi '632 discloses that the average particle diameter D50 is 14.7 to 30.8 μm (Examples 1 to 5). However, Kaneyoshi '632 fails to suggest or disclose spherical particles of the yttrium or lanthanide-containing compound having an average particle diameter of 10 to 80 μm as defined in claim 1, which has a sufficient breaking strength of at least 10 MPa to remain uncollapsed in the flame or plasma during spraying.

Moreover, as above, Kaneyoshi '632 discloses that the aspect ratio of the particles is 1.5 or less. However, Kaneyoshi '632 fails to disclose that the specific bulk density and cumulative volume of pores with the specific radius as defined in claim 2. The breaking strength and bulk density of the particles are different depending on pores open at particle surfaces, crystal

size and the like. Hence, there is obtained particles having widely different properties according to the different preparation processes or conditions.

Kaneyoshi '632 discloses a method which is completely different from that of the present invention. As a matter of course, there cannot be obtained the particles having the same properties as disclosed in the invention. Therefore, the present invention is not anticipated by Kaneyoshi '632. Reconsideration and withdrawal of this rejection are requested.

Issues Under 35 U.S.C. § 103(a)

The Examiner has rejected claims 3 and 4 under 35 U.S.C. § 103(a) as being obvious over Kaneyoshi '632. Applicants respectfully traverse this rejection. As explained above, Kaneyoshi '632 is unable to obtain the particles as claimed. No motivation exists to utilize the present method, thus, the present claims are non-obvious over Kaneyoshi '632.

Furthermore, the fines which stick to particle surfaces without being granulated are not introduced into the plasma flame during the spraying step and are thus kept unmelted so that they are incorporated in or stick to the sprayed coating. In order to prevent the above inconvenience caused by the prior art, the

present inventors have found that the thermal spray spherical particles should remain uncollapsed in the flame or plasma during spraying. Also, in order that particles of metal compound are thermally sprayed, without dust generation, to form a coating having improved bond strength, the particles must be completely melted in the flame or plasma during the spraying step and the supply of the feed particles must be precisely controlled.

The thermal spray particles of the yttrium or lanthanide-containing compound, having a specific breaking strength of at least 10 MPa and average particle diameter of 10 to 80 μm according to the present invention, do not collapse in the spraying flame or plasma and thus form a coating in which no unmelted fragments are incorporated or to which surface no unmelted fragments stick. Especially, by processing a starting oxide powder under predetermined conditions, thermal spray particles having the desired physical properties are produced. Plus, the coating obtained by thermally spraying the particles has the advantages of no dust deposition, increased smoothness, high purity, improved bond, and improved corrosion resistance, as proved in Examples 1-5.

Further, if the bulk density is out of the range defined in claim 2, that is, less than 1.0 g/cm^3, particles are less dense and hence, rather weak, with a risk of collapsing upon spraying. Also,

the aspect ratio (the ratio of major diameter to minor diameter of a particle) of more than 2 indicates that particles have an irregular, needle, flaky or other shape dissimilar from sphere, leading to disturbed flow. To obtain the smooth flow, the cumulative volume of pores with a radium of up to 1 μm should be less than 0.5 cm^3/g. If not, particles become more irregular on their surface, that is, smooth particles are not obtainable, resulting in poor flowing. As demonstrated in Examples 6-13, using the particles of the invention, a sprayed coating of high purity is formed with minimal generation of dust therefrom. The sprayed component has a smooth coating with a reduced surface roughness and is useful as a corrosion resistant component for operation in a corrosive gas atmosphere such as halide gas plasma.

Kaneyoshi '632 fails to disclose a coating having these remarkable properties obtained from the particles of the invention. As mentioned above, the raw materials and the conditions of the preparation method of the invention are quite different from the method of Kaneyoshi '632, so that the above properties of the invention are not obtained from Kaneyoshi. Accordingly, no *prima facie* case of obviousness exists. Reconsideration and withdrawal of this rejection are requested.

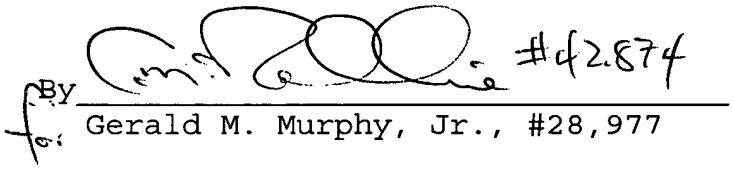
In view of the above, Applicants respectfully submit that the present claims are neither anticipated nor rendered obvious by Kaneyoshi '632. Accordingly, the Examiner is respectfully requested to withdraw all rejections and allow the currently pending claims.

If the Examiner has any questions or comments, please contact Craig M. McRobbie, Reg. No. 42,874 at the offices of Birch, Stewart, Kolasch & Birch, LLP at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP



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